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ADVERTISING, PERCEIVED QUALITY AND STRATEGIC ENTRY DETERRENCE AND ACCOMODATION (*)

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Abstract. When faced with the choice between two brands of a homogeneous good, consumers—*ceteris paribus*—have been observed to prefer the brand with which they have become familiar through advertising to the unadvertised brand. Some consumers are even prepared to pay a price premium for the advertised brand. Taking this behaviour as a *datum*, we show that an incumbent monopolist can use advertising to erect a barrier to entry or to influence the nature of entry (strategic entry accomodation).

1. INTRODUCTION

There is a vast literature on the economic effects of advertising. Since this paper is concerned with entry deterrence, we shall mainly refer to those papers which have dealt directly with the issue of the « anticompetitive effects » of advertising.

A considerable proportion of the literature consists of papers which do not address the question of how and/or why consumers react to advertising, but simply assume that advertising has the effect of increasing demand. Examples are the papers by Williamson (1963), Spence (1980) Bourguignon and Sethi (1981).

Our paper belongs to the category of those which do take into account the way in which advertising affects consumer choices. The papers in this category are usually based on models in which consumers' reaction

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to advertising is « rational ». To see this, we shall further distinguish between models in which products are differentiated and models in which products are homogeneous.

One of the most influential papers in the first sub-category is the one by Nelson (1974). Nelson distinguishes between « search qualities » and « experience qualities » as source of product differentiation. A search quality is one which the consumer can determine prior to purchase of the brand (e.g. the style of a dress). In this case false claims by the seller will not induce any purchases and will only damage the seller's reputation. Thus only valid claims (if at all) will be made and therefore consumers' response to advertising will be rational.

Experience qualities, on the other hand, are those which are determined after purchase and use (e.g. the taste of a brand of canned tuna fish). In this case there is scope for misleading advertising, since lies might induce trial purchases. However, Nelson argues that high-quality brands will obtain more repeat purchases, *ceteris paribus*, than low-quality brands. Thus—he argues further—sellers of high-quality brands will spend more to persuade consumers to try their goods, since, *ceteris paribus*, the present value of a trial purchase is larger. Therefore the *level* of advertising for experience goods is positively correlated with quality, regardless of what individual ads actually claim. Since the more advertised brands are of higher quality, it is again rational for consumers to be influenced by advertising. Similar ideas are discussed by Kotowitz and Mathewson (1979) and Schmalensee (1978).

In our paper we assume that products are not differentiated. When products are *homogeneous* insistence on rationality of consumers' response to advertising makes it necessary to assume that consumers are not aware of the existence and/or price of a particular brand. This is the approach taken by Butters (1977) and later followed by Schmalensee (1983). Butter's models is based on the following assumptions:

(i) sellers mail advertising messages to potential buyers informing them of their price and location;

(ii) buyers have no other means of receiving information about sellers and therefore if they receive no ads, they cannot buy the product.

Advertisements are allocated randomly among consumers, who simply choose the advertisements that offer the lowest price to them.

Butters shows that despite the fact that the goods are homogeneous, prices may be different. High-priced sellers advertise more intensively than low-priced sellers, partly because they must advertise more to get the

same number of customers, and partly because the high prices generate the revenue sufficient to pay for the extra advertising. Butters claims (p. 482) that « the broad predictions of the theory seem consistent with at least some casual observation: Bayer's aspirin, a heavily advertised brand, sells at a much higher price than Swan's aspirin, Lavoris mouthwash sells at a price more than twice as high as Stop and Shop's brand ... ».

One can have legitimate doubts about the explanation provided by Butters, however. According to Butter's model, if Bayer's aspirin sells at a higher price than other brands, it must be because consumers who buy it are not aware of the existence of the other—cheaper—brands. Our experience, however, tells us that for goods like aspirin the opposite is true: typically consumers do know of the existence of different brands and can learn about their prices easily and without cost (usually they obtain goods from shops where the different brands are shelved nearby). Of course, once we recognise this, we must be prepared to admit that in some instances consumers' response to advertising is « irrational ».

There seems to be a general tendency among economists to reject the hypothesis of irrational consumer behaviour and to restrict attention to models in which consumers behave rationally. This « research strategy » seems highly inadequate in the face of observed behaviour (1) and reflects an aprioristic view which is not shared by businissmen: cf. the following passage quoted in Scherer (1980, p. 382) where the leading seller of lemon juce in 1971 stated

> « Although reconstituted lemon juce is virtually indistinguishable one brand from another, heavy emphasis on the ReaLemon brand through its media effort should create such memorability for the brand, that almost imaginary superiority would exist in the mind of consumers, a justification for the higher price we are asking ».

The approach adopted in this paper is as follows: we take as a *datum* frequently observed and much documented « irrational » behaviour on the part of consumers and show how an incumbent firm can exploit it in order to erect a strategic barrier to entry or to affect the opportunities available to the entrant (strategic entry accomodation). The consumer behaviour which we take as a *datum* is the following.

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(1) Scherer (1980, p. 382), for example, notes that « double-blind experiments have repeatedly demonstrated that consumers cannot consistently distinguish premium from popular-priced brands when labels are affixed—correctly or not ».

If two brands of a homogeneous product (e.g. aspirin) are available and one is heavily advertised while the other is not, then

(i) *ceteris paribus* (i.e. if there are no differences in prices) consumers strictly prefer the « well-known » brand, that is, the brand with which they have become familiar through advertising;

(ii) if prices are different, some consumers may still prefer the advertised brand, that is, they are prepared to pay a price premium for it.

Furthermore—bearing in mind the example of aspirin—we shall assume that advertising cannot increase the size of the market (whether a consumer buys aspirin or not, is something which depends entirely on her health and no amount of advertising can induce a consumer who does not need aspirin to buy it (2). Thus advertising may only influence a consumer in her choice of brand and not in her choice whether or not to buy the good (3). Besides aspirin, other examples which come to mind are: medicines in general, soap, detergents (4), cigarettes and tobacco (assuming—as it seems indeed to be the case—that the number of people induced to start smoking or to become heavier smokers by advertising is negligible), beer, liqueur, toothpaste. All these products are in general heavily advertised.

Given our assumptions, it is clear that a protected monopolist (that is, a monopolist who does not face the threat of entry) would *not* advertise. We show, however, that the threat of entry may induce an incumbent monopolist to spend large sums of money in advertising in order to deter entry (strategic entry deterrence) or to influence the nature of entry (strategic entry accomodation). The reason why advertising can be used as a (strategic) barrier to entry is as follows. If the incumbent carries out a «substantial» advertising campaign in the pre-entry phase, an entrant will be faced with two alternatives: advertise or not advertise. In the

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(2) Unless there were consumers who needed aspirin but did not know of its existence: a situation which we can safely rule out.

(3) The distinction between goods for which advertising can increase the size of the market and goods for which it cannot is probably at the basis of the distinction which can be found in the literature (Friedman (1983, pp. 142 ff.), see also Braithwaite (1928)), between *predatory* and *cooperative* advertising. In an oligopolistic market, advertising is predatory if the gain to the firm that advertises is totally at the expense of the rival firms, whereas it is cooperative if advertising expenditure by one firm increases the sales of each firm in the market.

(4) Scherer (1980, p. 389), for example, observes that « in the soap and detergents industry it seems clear that enormous sums spent on advertising (e.g. $ 275 million in 1967, or roughly 11% of sales) do little more than cancel rival messages out, since aggregate consumption can hardly be affected much by advertising ».

latter case she would have to charge a very low price in order to have positive sales (if prices are equal, consumers will prefer the « well-known » brand). The more effective advertising, the lower the price, and if advertising is sufficiently effective revenue will not be sufficient to cover the (opportunity) cost of entry. Therefore, entry without advertising would not be profitable. The other alternative for the entrant is to try and offset the advertising campaign of the incumbent. If the entrant does so, her revenue will be much higher than in the previous case, but—if the incumbent's pre-entry advertising was on a very large scale—it will not be sufficient to cover the high advertising costs (plus the cost of entry). Therefore entry will be deterred, while the incumbent can still make positive profits, since monopoly revenue is much higher than duopoly revenue.

In some cases, however, the incumbent would have to advertise on a very large scale in order to deter entry and this may not be profitable: it may be more profitable to accomodate entry. However, the incumbent may still want to advertise in order to dissuade the entrant from entering herself with a large-scale advertising campaign which would be detrimental for the incumbent. Thus in some cases advertising will give rise to strategic entry deterrence and in other cases to strategic entry accomodation.

The paper is organised as follows. In section 2 we present the model and in section 3 we develop the formal analysis. In the final section we relate our results to the existing literature.

2. THE MODEL

We consider a three-stage game between an incumbent monopolist and a potential entrant. In stage 1 the incumbent decides whether or not to advertise and how much to spend on advertising. In stage 2 the potential entrant—having observed the action taken by the incumbent in the previous period—decides whether or not to enter. If she decides to enter, she also chooses a level of advertising expenditure (possibly zero). Finally, in the last stage the two players—having observed each other's advertising campaigns—play a Cournot-Nash game in which each firm selects its output to maximise its own profits, taking as given the output of the other firm (5).

(5) In Bonanno (1985*a*, *b*) a more complex model was considered in which the second-stage game was a *simultaneous* game in advertising expenditures (that is, in stage 2, if the entrant decides to enter, the two players simultaneously choose a level of advertising expenditure, possibly zero). In other words, the incumbent monopolist is allowed to react to entry by stepping up his advertising campaign of

We assume that there is an opportunity cost of entry $\varepsilon > 0$. Thus the potential entrant will decide to enter only if she can make a profit of at least ε, where ε represents the profit which can be made elsewhere (e.g. by investing in a safe asset).

The notion of equilibrium which we consider is that of subgame-perfect equilibrium (Selten (1975)). Thus we will solve the game backwards, starting from the final stage.

As said in the Introduction, we shall assume that:

(1) the good which we consider is essentially homogeneous and therefore there is no scope for product differentiation;

(2) consumers are « naturally » informed about the good: they know that it exists, what properties it has and where to obtain it (e.g. they know that they can obtain aspirin from any chemist);

(3) when consumers go to a shop which sells the good, they can observe (at no cost) the different brands and the respective prices (the different brands are shelved nearby);

(4) partly as a consequence of (1)-(3) and partly because of the nature of the good, advertising cannot increase the size of the market.

Examples of goods which satisfy (1)-(4) were given in the Introduction (aspirin can be taken as the prototype). Finally, we shall assume the following behaviour on the part of consumers. If two brands are available and one is heavily advertised, while the other is not, then

(5) *ceteris paribus* (i.e. if there are no differences in prices) all consumers strictly prefer the « well-known » brand, that is, the brand with which they have become familiar through advertising;

(6) if prices are different, some consumers may still prefer the advertised brand, that is, they are prepared to pay a price premium for it.

In this section we will formalize this behaviour. Note, however, that we are *not* explaining why consumers, *ceteris paribus*, prefer the adver-

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stage 1. However, the results obtained there are qualitatively the same as those obtained in the simplified model used here.

The solution concept for the post-entry game is Cournot-Nash. However, our results remain true also in the Betrand-Nash case (where firms compete in prices rather than outputs). The reason why we have not chosen the latter solution concept is that—although it simplifies the analysis—it has the unsatisfactory feature that it yields the competitive outcome (zero prices) in the case where the two firms choose advertising campaigns which cancel each other out.

tised brand. We simply take it as a *datum*: it is a well documented and not at all uncommon phenomenon (6).

Advertising here can be thought of as conventional advertising (e.g. TV commercials). Through it consumers become familiar with the advertised brand. This gives rise to what has been called « image » differentiation, as opposed to « real » or « quality » differentiation (see Scherer (1980, pp. 380 ff.)).

The behaviour outlined above is the same which would be observed if consumers believed that the unadvertised brand were of lower quality. That is, consumers behave *as if* they perceived the unadvertised brand as a product of lower quality. Thus we shall formalise it by assuming that through advertising a firm can lower the « perceived quality » of its rival's unadvertised product. Note, however, that we are not assuming that « perceived quality » is an increasing function of the amount of advertising (otherwise it would not be true that advertising cannot increase the size of the market). Note also that we allow for the possibility that the firm which advertises is the entrant, in which case it is the incumbent's product which is treated by consumers as if it were of lower quality. Thus we do not introduce any asymmetries in the effectiveness of advertising between incumbent and entrant (we shall return to this point in the final section).

We shall use a model which was first introduced by Gabszewicz and Thisse (1979). There is a continuum of consumers, represented by the unit interval [0, 1]. Consumers have identical preferences but different incomes. The income of consumer $t \in [0, 1]$ is given by

$$E(t) = Et\,, \quad E > 0\,. \tag{1}$$

Each consumer either buys one unit of the product or nothing. In the latter case his utility is given by

$$U\big(0, E(t)\big) = U_0 E(t)\,, \quad U_0 > 0\,. \tag{2}$$

Let $A_i \geqslant 0$ be the advertising expenditure of the incumbent in stage 1 and $A_e \geqslant 0$ be the advertising expenditure of the entrant in stage 2 (7).

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(6) It is clear that any explanation would have to be based on psychological—rather than « economic » or « rational »—factors (cf. Scherer (1980, pp. 380 ff.)).

(7) Like Schmalensee (1983, p. 638), we shall assume that once exposed to a certain amount of advertising consumers remember it forever. That is, the effects of advertising are assumed to be infinitely durable.

As said above, we shall assume that if one firm advertises more than the other, the latter's product will be treated by consumers as if it were of lower quality. Clearly, this assumption is reasonable only if the difference in the advertising expenditure is not trivial. Thus for advertising to induce consumers to behave as explained above, we shall require the difference in the advertising expenditures to be not less than K, where K is a given positive constant which can be interpreted as the cost of a sufficiently intensive advertising campaign (e.g. at least five TV commercials a week for at least six months). Thus we must distinguish three cases.

Case 1: $|A_i - A_e| < K$. In this case the effects of the advertising campaigns of the two firms cancel out and consumers treat the two products as perfect substitutes. Let

$$U(1, E(t) - p) = U_1(E(t) - p), \quad U_1 > U_0 \tag{3}$$

be the utility consumer t derives from consuming one unit of either product at price p. Let t' be the consumer who is indifferent between buying and not buying the product. Then t' is obtained by solving the following equation with respect to t:

$$U(0, E(t)) = U(1, E(t) - p). \tag{4}$$

Thus

$$t' = \frac{U_1}{E(U_1 - U_0)} p \tag{5}$$

Consumers who are richer than t' will prefer to buy and consumers who are poorer than t' will prefer not to buy. Thus demand in this case is given by

$$D(p) = 1 - t' = 1 - \frac{U_1}{E(U_1 - U_0)} p \tag{6}$$

Case 2: $A_i \geq A_e + K$. In this case the entrant's product is perceived as a low-quality one. Let p_e be the entrant's price and p_i the incumbent's price. The utility of consuming one unit of the incumbent's product at price p_i is given by (3) (with p replaced by p_i), while the utility of con-

suming one unit of the entrant's product at price p_e is given by

$$U(L, E(t)-p_e) = U_L(E(t)-p_e), \quad U_1 > U_L > U_0. \tag{7}$$

In this case the demand functions for the two products are obtained as follows. Let $\bar{t}$ be the consumer who is indifferent between the two goods. Then $\bar{t}$ is obtained by solving the following equation with respect to t

$$U(1, E(t)-p_i) = U(L, E(t)-p_e). \tag{8}$$

Thus

$$\bar{t} = \frac{U_1}{E(U_1-U_L)}p_i - \frac{U_L}{E(U_1-U_L)}p_e \tag{9}$$

(note that $\bar{t} > 0$ requires $p_e < p_i$, since $U_L < U_1$). Richer consumers will prefer the incumbent's product, while poorer consumers will prefer the entrant's product. Next define t_0 to be the consumer who is indifferent between buying nothing and buying the entrant's product. Then

$$t_0 = \frac{U_L}{E(U_L-U_0)}p_e. \tag{10}$$

Then, over the relevant range [8], demand for the incumbent's product is given by D_1 and demand for the entrant's product is given by D_2, where

$$\left.\begin{aligned} D_1(p_i, p_e) &= 1-\bar{t} = 1-\frac{U_1}{E(U_1-U_L)}p_i + \frac{U_L}{E(U_1-U_L)}p_e, \\ D_2(p_i, p_e) &= \bar{t}-t_0 = \frac{U_1}{E(U_1-U_L)}p_i - \frac{U_L(U_1-U_0)}{E(U_1-U_L)(U_L-U_0)}p_e. \end{aligned}\right\} \tag{11}$$

Case 3: $A_e \geq A_i + K$. In this case the incumbent's product is treated by consumers as if it were of lower quality and we have a situation symmetric to that of Case 2 above, with the incumbent's and entrant's roles reversed. Thus demand for the incumbent's product is given by D_2 with p_i and p_e interchanged, and demand for the entrant's product is given by D_1 with p_i and p_e interchanged.

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[8] For a more detailed derivation of the demand functions see Bonanno (1986).

We can now solve the three-stage game backwards in order to determine the subgame-perfect equilibria.

3. THE FORMAL ANALYSIS

Throughout the paper we shall assume that the costs of production are zero. It will be clear, however, that our results do not depend on this simplifying assumption.

An immediate consequence of our assumptions is that a protected monopolist would not advertise. Let π^m be the profit of a protected monopolist. Then using (6) we obtain

$$\pi^m = \frac{E(U_1 - U_0)}{4U_1} . \tag{12}$$

We can now determine the profits of incumbent and entrant in the third-stage game as functions of the advertising expenditures A_i and A_e.

Lemma 1: In Case 1 of section 2 (the two advertising campaigns cancel out) there is a unique Cournot-Nash equilibrium of the third-stage game with corresponding profits

$$\pi_i = \frac{E(U_1 - U_0)}{9U_1} - A_i \tag{13}$$

and

$$\pi_e = \frac{E(U_1 - U_0)}{9U_1} - A_e - \varepsilon \tag{14}$$

(where subscript « i » stands for « incumbent » and « e » for « entrant », and ε is the cost of entry).

Proof: Let q_i and q_e be the output of incumbent and entrant, respectively. Using (6) the inverse demand function is given by

$$p = (1 - q_i - q_e)E(U_1 - U_0)/U_1 .$$

The incumbent's and entrant's profit functions are therefore given by $\pi_i(q_i, q_e) = pq_i$ and $\pi_e(q_i, q_e) = pq_e$, respectively. π_i is strictly concave

in q_i and π_e is strictly concave in q_e. Thus taking first-order conditions we obtain a unique Cournot-Nash equilibrium at which profits are given by (13) and (14). //

Lemma 2: In Case 2 of section 2 (the incumbent advertises « substantially » more that the entrant) there is a unique Cournot-Nash equilibrium of the third-stage game with corresponding profits

$$\pi_i = R^* - A_i \tag{15}$$

and

$$\pi_e = \hat{R} - A_e - \varepsilon \tag{16}$$

respectively, where

$$R^* = \frac{E(U_1 - U_0)(2U_1 - U_L - U_0)^2}{U_1(4U_1 - U_L - 3U_0)^2} \tag{17}$$

and

$$\hat{R} = \frac{E(U_1 - U_0)^2(U_L - U_0)}{U_L(4U_1 - U_L - 3U_0)^2}. \tag{18}$$

A proof of Lemma 2 can be found in Bonanno (1985*a*, *b*) and is along the following lines. We first invert (11) and obtain π_i and π_e as functions of q_i and q_e. Again, π_i is strictly concave in q_i and π_e is strictly concave in q_e. Solving the first-order conditions we obtain (15) and (16). By symmetry we also obtain the following lemma.

Lemma 3: In Case 3 of section 2 (the entrant advertises « substantially » more than the incumbent) there is a unique Cournot-Nash equilibrium of the third-stage game with corresponding profits

$$\pi_i = \hat{R} - A_i \tag{19}$$

and

$$\pi_e = R^* - A_e - \varepsilon \tag{20}$$

where R^* and $\hat{R}$ are given by (17) and (18) respectively.

We can consider

$$v = U_L - U_0 \tag{21}$$

as a measure of the « *effectiveness of advertising* ». The two limit cases are: $v = U_1 - U_0$ and $v = 0$. In the first case advertising is not effective at all: consumers are sophisticated enough and pay attention only to the « real » properties or qualities of the products. In the second case consumers are strongly influenced by advertising and treat the unadvertised product as a very low quality one, that is, $U_L = U_0$. Therefore v is greater than zero and less than $(U_1 - U_0)$, and the smaller v the more effective advertising. Thus the expression « sufficiently effective advertising » should be interpreted and « v sufficiently close to zero ».

It is easy to check that (see Bonanno (1985*a*, *b*))

$$\left.\begin{aligned} &\frac{dR^*}{dv} < 0\,,\ \lim_{v\to 0} R^* = \pi^m = \frac{E(U_1 - U_0)}{4U_1}\,, \\ &\lim_{v\to(U_1-U_0)} R^* = \frac{E(U_1 - U_0)}{9U_1} \end{aligned}\right\} \tag{22}$$

and

$$\frac{d\hat{R}}{dv} > 0\,, \qquad \lim_{v\to 0} \hat{R} = 0\,, \qquad \lim_{v\to(U_1-U_0)} \hat{R} = \frac{E(U_1 - U_0)}{9U_1}\,. \tag{23}$$

Lemmata 1-3 give us the payoffs which will be taken into account by a potential entrant with rational expectations at the second stage of the game where she has to decide whether or not to enter and how much to spend on advertising. The decision will be a function of A_i (the incumbent's advertising expenditure in stage 1) and of the value of the parameter K. Figure 1 summarizes the results of Lemmata 4-7 which are stated and proved in the Appendix.

We can now determine the perfect equilibria of the three-state game for all possible values of the parameter K. In order to make things interesting we shall assume throughout that the opportunity cost of entry ε is less than $E(U_1 - U_0)/(9U_1)$, which is the duopoly profit in the absence of advertising (cf. Lemma 1).

Proposition 1: If

$$K \geq \frac{5E(U_1 - U_0)}{36U_1} \tag{24}$$

A_i	K		
	$0 < K < \dfrac{5E(U_1 - U_0)}{72U_1}$	$\dfrac{5E(U_1 - U_0)}{72U_1} \leqslant K < \dfrac{5E(U_1 - U_0)}{36U_1}$	$K \geqslant \dfrac{5E(U_1 - U_0)}{36U_1}$
$A_i = 0$	Entry with $A_e = K$		Entry with $A_e = 0$
$0 < A_i < K$	Entry with $A_e = A_i + K$ if $A_i < 5E(U_1 - U_0)/(36U_1) - K$ Entry with $A_e = 0$ if $A_i \geqslant 5E(U_1 - U_0)/(36U_1) - K$		Entry with $A_e = 0$
$A_i \geqslant K$	Entry with $A_e = A_i + K$ if $A_i < E(U_1 - U_0)/(4U_1) - K - \varepsilon$ No entry if $A_i \geqslant E(U_1 - U_0)/(4U_1) - K - \varepsilon$	Entry with $A_e = A_i - K + \delta$ if $A_i < K + E(U_1 - U_0)/(9U_1) - \varepsilon$ ($\delta > 0$ arbitrarily small) No entry if $A_i \geqslant K + E(U_1 - U_0)/(U_1 9) - \varepsilon$	

Figure 1. The entrant's decision as a function of A_i and K when advertising is sufficiently effective.

and advertising is sufficiently effective, there exists a unique perfect equilibrium of the three-state game where the incumbent does not advertise ($A_i = 0$), the potential entrant enters without advertising ($A_e = 0$) and both firms make positive profits equal to

$$\pi_i = \frac{E(U_1 - U_0)}{9U_1} \tag{25}$$

and

$$\pi_e = \frac{E(U_1 - U_0)}{9U_1} - \varepsilon . \tag{26}$$

Proof: See Appendix.

The proof can be summarised as follows. Looking at fig. 1 we can see that when K satisfies inequality (24) the incumbent can deter entry only by setting $A_i = K + E(U_1 - U_0)/(9U_1) - \varepsilon > K$. However, given the large value of K, the resulting profits (equal to $\pi^m - A_i$, where π^m is given by (12)) would be very low; thus it is more profitable for the incumbent to accomodate entry by setting $A_i = 0$.

More interesting is the result of the following proposition. Here *the incumbent finds it optimal to advertise even though the level of advertising expenditure he chooses is not sufficient to deter entry*. The purpose of the incumbent's advertising is to influence the way in which entry will take place. In particular, *the incumbent's advertising has the purpose of eliminating the attractiveness of a large-scale advertising campaign for the entrant* ($A_e = A_i + K$), which would mean very low post-entry profits for the incumbent. Thus we have a situation of *strategic entry accomodation*, in the form of a sunk cost whose only purpose is to limit the options available to the entrant and thereby influence the nature of entry.

Proposition 2: If

$$\frac{E(U_1 - U_0)}{12U_1} + \frac{\varepsilon}{2} < K < \frac{5E(U_1 - U_0)}{36U_1} \tag{27}$$

and advertising is sufficiently effective, there exists a unique perfect equilibrium of the three-stage game where the incumbent advertises and sets

$$A_i = \frac{5E(U_1 - U_0)}{36U_1} - K > 0 \tag{28}$$

the potential entrant enters without advertising ($A_e = 0$) and both firms make positive profits equal to

$$\pi_i = \frac{E(U_1 - U_0)}{9U_1} - A_i = K - \frac{E(U_1 - U_0)}{36U_1} \tag{29}$$

and

$$\pi_e = \frac{E(U_1 - U_0)}{9U_1} - \varepsilon . \tag{30}$$

Proof: See Appendix.

Note that *the incumbent does not even choose a level of advertising expenditure sufficiently high for consumers to react to it by treating the entrant's product as a low-quality one.* The only purpose of the incumbent's advertising is to make it unprofitable for the entrant to come in with a large-scale advertising campaign.

The following result concludes our analysis.

Proposition 3: If

$$\frac{5E(U_1 - U_0)}{72U_1} < K < \frac{E(U_1 - U_0)}{12U_1} + \frac{\varepsilon}{2} \tag{31}$$

and advertising is sufficiently effective, there exists a unique perfect equilibrium of the three-stage game where the incumbent advertises and sets

$$A_i = K + \frac{E(U_1 - U_0)}{9U_1} - \varepsilon \tag{32}$$

the potential entrant stays out and the incumbent's profits are positive and equal to

$$\pi_i = \frac{5E(U_1 - U_0)}{36U_1} - K + \varepsilon . \tag{33}$$

If

$$K < \frac{5E(U_1 - U_0)}{72U_1} \tag{34}$$

and advertising is sufficiently effective, there exists a unique perfect equi-

librium of the three-stage game where the incumbent advertises and sets

$$A_i = \frac{E(U_1 - U_0)}{4U_1} - K - \varepsilon \tag{35}$$

the potential entrant stays out and the incumbent's profits are positive and equal to

$$\pi_i = K + \varepsilon . \tag{36}$$

Proof: See Appendix.

An intuitive explanation of this result was given in the Introduction. Note the interesting fact that advertising is used as a barrier to entry only when the parameter K takes on *small* values.

In the next section we relate our results to the existing literature.

4. REMARKS AND CONCLUSION

A number of remarks can be made about the results obtained above.

(i) With a few exceptions, it is widely recognized in the literature that advertising can give rise to barriers to entry. However, it has been claimed that a *necessary* condition for advertising to restrict entry is that there be *asymmetries* in the effectiveness of advertising between established firms and new entrants. Schmalensee (1973, p. 584), for example, writes that «if existing firms and the entrant can produce equally effective advertising and equally desirable products», it is hard to see how advertising can be used to restrict entry. Comanor and Wilson (1979, p. 456) express the same view (9). Apart from the obvious asymmetry arising from the fact that the incumbent has the first move, in our model there are no asymmetries between incumbent and entrant as far as

(9) The commonly accepted explanation of why advertising can restrict entry is well summarized by Comanor and Wilson (1967, p. 425) in the following passage: « Because of buyer inertia and loyalty, more advertising messages per prospective customer must be supplied to induce brand switching as compared with repeat buying. Since the market which prospective entrants must penetrate is made up largely of consumers who have purchased existing products, advertising costs per customer for new entrants will be higher than those of existing firms who are maintaining existing market positions...: This effect of advertising creates an absolute cost advantage for established producers, since they need not incur penetration costs ».

the effectiveness of advertising is concerned. In our model the entrant can indeed produce « an equally desirable product and equally effective advertising ». The entrant can always neutralise the advertising campaign of the incumbent or indeed outdo the incumbent's advertising. We can therefore conclude that the above view is not correct: asymmetries in advertising effectiveness are a sufficient but not necessary condition for advertising to restric entry ([10]).

(ii) As was pointed out in section 2, our assumptions imply that a protected monopolist would not advertise. We then showed that for a wide range of values of the parameter K (given by (27), (31) and (33)), the threat of entry induces an incumbent monopolist to advertise (in order either to deter entry or to influence the nature of entry). Thus strategic entry deterrence or accomodation is achieved through « excessive » advertising. This is to be contrasted with the result obtained in recent contributions to the literature (Schmalensee (1983), Fudenberg and Tirole (1984)), that in some cases the threat of entry may induce the incumbent monopolist to advertise *less* than he would if entry were not possible. Our result, therefore, bears some resemblance with that obtained in the literature on the role of investment in entry deterrence (Spence (1977), Dixit (1980)).

(iii) One way of interpreting the result of Proposition 3 is as follows: advertising by the incumbent deters entry into the market because it increases the cost of entry. The possibility of deterring entry by raising rivals' costs has been considered before in the literature. For example Williamson (1968) observed that by setting high wage rates in the industry, the incumbent increases his own costs and those of the entrant. The direct

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([10]) The view that, without asymmetries in advertising effectiveness between established firms and new entrants, advertising cannot deter entry was also criticized by Cubbin (1981). However, Cubbin's model contains no analysis of how advertising affects consumer choices and fails—in our view—to prove the above point for the following reasons. As Cubbin himself notes (p. 289), if the potential entrant is a rational agent, the decision whether or not to enter will depend entirely on the outcome of the post-entry game. Let $(x_1^*, x_2^*, A_1^*, A_2^*)$ be the outcome of the post-entry game, where x_i and A_i are firm i's output and advertising expenditure, respectively—firm 1 being the incumbent and firm 2 the entrant. Then the functions $f(x_2)$ and $g(A_1)$, which in Cubbin's model represent the entrant's expectations of the established firm's post-entry levels of output and advertising (where x_1 and A_1 are the *pre-entry* levels of output and advertising of the incumbent) should be

$$f(x_1) = \text{constant} = x_1^*, \quad g(A_1) = \text{constant} = A_1^*$$

that is, the entrant's decision will be independent of both the pre-entry output and advertising of the established firm. Instead, Cubbin's analysis is based on the assumptions (pp. 290 and 293) that $f' > 0$, $g > 0$, $g' > 0$.

effect of this upon the incumbent is unfavourable, but if the indirect effect is to deter the rival's entry, then the ploy may well be beneficial to him in overall terms (on this see also Salop and Scheffman (1983)). In our model advertising by the incumbent makes it necessary for the entrant to add a sunk component to the (opportunity) cost of entry: if the entrant does not want her product to be perceived as an inferior one, she has to convert liquid assets into advertising « capital » which is completely non-salvageable in case of exit. We can therefore say that in our model advertising by the incumbent creates a *sunk cost barrier to entry*.

(iv) The situation modelled in this paper is somewhat similar to Dixit's (1982) framework, where the incumbent incurs a cost C which is a deadweight loss if no entry occurs but which helps the incumbent in the event of a price war. As Dixit notes, sunk capacity is the typical example. Dixit's framework applies mainly to situations in which by incurring the cost C the incumbent creates the right incentives for himself to be more aggressive towards an entrant than he would be otherwise. The entrant, knowing that it will be optimal *ex-post* for the incumbent to react to entry aggressively, will stay out. In our case the sunk cost represented by the incumbent's advertising expenditure performs a different role: it does not have the purpose of creating incentives for an aggressive response to entry but it directly imposes an extra (sunk) cost on the entrant. In fact, the entrant can—if she wants to—neutralise the pre-entry action of the incumbent or even outdo it in terms of aggressiveness, but it would be too expensive to do so. Furthermore, our model is richer than Dixit's in that it shows the possibility, unexplored by Dixit, that the incumbent may find it optimal to incur a sunk cost not in order to deter entry but in order to limit the options available to the entrant. That is, in our model we have strategic entry accomodation as well as strategic entry deterrence.

APPENDIX

The following lemmata contain the results shown in fig. 1.

Lemma 4: Let $A_i = 0$. Then

(i) if

$$K \geqslant \frac{5E(U_1 - U_0)}{36U_1} \tag{A1}$$

the potential entrant enters with $A_e = 0$ and the corresponding profits are given by

$$\pi_i = \frac{E(U_1 - U_0)}{9U_1} \tag{A2}$$

and

$$\pi_e = \frac{E(U_1 - U_0)}{9U_1} - \varepsilon . \tag{A3}$$

(ii) If

$$K < \frac{5E(U_1 - U_0)}{36U_1} \tag{A4}$$

and advertising is sufficiently effective, the potential entrant enters with $A_e = K$ and the corresponding profits are

$$\pi_i = \hat{R} \tag{A5}$$

and

$$\pi_e = R^* - K - \varepsilon \tag{A6}$$

(where R^* and $\hat{R}$ are given by (17) and (18) respectively).

Proof: It is clear that the potential entrant would only choose between $A_e = 0$ and $A_e = K$. In the former case her profit would be given by (A3), while in the latter case it would be given by (A6). By (22) if K satisfies inequality (A1), (A3) is greater than (A6) for all v. On the other hand, by (22) for each K satisfying inequality (A4) there exists a v sufficiently close to zero such that (A6) is greater than (A3). //

Lemma 5: Let $0 < A_i < K$. Then

(i) if K satisfies (A1) or if K satisfies (A4) and $A_i \geqslant 5E(U_1 - U_0)/(36U_1) - K$, the potential entrant enters with $A_e = 0$ and the corresponding profits are given by

$$\pi_i = \frac{E(U_1 - U_0)}{9U_1} - A_i \tag{A7}$$

and

$$\pi_e = \frac{E(U_1 - U_0)}{9U_1} - \varepsilon . \tag{A8}$$

(ii) If K satisfies (A4) and $A_i < 5E(U_1 - U_0)/(36U_1) - K$ and advertising is sufficiently effective, the potential entrant enters with $A_e = A_i + K$ and the cor-

responding profits are

$$\pi_i = \hat{R} - A_i \tag{A9}$$

and

$$\pi_e = R^* - A_i - K - \varepsilon . \tag{A10}$$

Proof: It is clear that the potential entrant would only choose between $A_e = 0$ and $A_e = A_i + K$. In the former case her profit would be given by (A8), while in the latter case it would be given by (A10). By (22) if K satisfies (A1) or if K satisfies (A4) and $A_i \geq 5E(U_1 - U_0)/(36U_1) - K$ then (A8) is greater than (A10) for all v. On the other hand, if K satisfies (A4) and $A_i < 5E(U_1 - U_0)/(36U_1) - K$ then there exists a v sufficiently small such that (A10) is greater than (A8). //

Lemma 6: Let $A_i \geq K$. Then if advertising is sufficiently effective either the potential entrant does not enter, or she enters with $A_e > 0$.

Proof: If the entrant entered with $A_e = 0$, her payoff would be

$$\pi_e = \hat{R} - \varepsilon . \tag{A11}$$

By (23) for each cost of entry $\varepsilon > 0$, there exists a v sufficiently close to zero such that (A11) is negative. //

Lemma 7: Let $A_i \geq K$ and assume advertising is sufficiently effective (in the sense of Lemma 6). Then

(i) If $K \geq 5E(U_1 - U_0)/(72U_1)$ and $A_i \geq K + E(U_1 - U_0)/(9U_1) - \varepsilon$ the potential entrant does not enter and the incumbent's profits are given by

$$\pi_i = E(U_1 - U_0)/(4U_1) - A_i . \tag{A12}$$

(ii) If $K \geq 5E(U_1 - U_0)/(72U_1)$ and $A_i < K + E(U_1 - U_0)/(9U_1) - \varepsilon$ the potential entrant enters with $A_e = A_i - K + \delta$ (where $\delta > 0$ is arbitrarily small) and the corresponding profits are

$$\pi_i = E(U_1 - U_0)/(9U_1) - A_i \tag{A13}$$

and

$$\pi_e = E(U_1 - U_0)/(9U_1) - A_i - \varepsilon - \delta + K . \tag{A14}$$

(iii) If $K < 5E(U_1 - U_0)/(72U_1)$ and $A_i < -K + E(U_1 - U_0)/(4U_1) - \varepsilon$ the potential entrant enters with $A_e = A_i + K$ and the corresponding profits are given by

$$\pi_i = \hat{R} - A_i \tag{A15}$$

and

$$\pi_e = R^* - A_i - K - \varepsilon . \tag{A16}$$

(iv) If $K < 5E(U_1 - U_0)/(72U_1)$ and $A_i \geq -K + E(U_1 - U_0)/(4U_1) - \varepsilon$ the potential entrant does not enter and the incumbent's profits are biven by

$$\pi_i = E(U_1 - U_0)/(4U_1) - A_i . \tag{A17}$$

Proof: By Lemma 6, the entrant would only choose between $A_e = A_i - K + \delta$ (where $\delta > 0$ is arbitrarily small) and $A_e = A_i + K$. In the former case her profit would be given by (A14), while in the latter case her profit would be given by (A16). By (22) if $K \geq 5E(U_1 - U_0)/(72U_1)$ (A14) is greater than (A16) for all v (and δ arbitrarily small). In this case the entrant will enter only if (A14) is positive. A necessary and sufficient condition for this is $A_i < E(U_1 - U_0)/(9U_1) - K - \varepsilon$. This proves (i) and (ii). By (22) if $K < 5E(U_1 - U_0)/(72U_1)$ there is a v sufficiently close to zero such that (A16) is greater than (A14). In this case entry will occur only if (A16) is positive. For every A_i such that $A_i < E(U_1 - U_0)/(4U_1) - K - \varepsilon$ there exists a v sufficiently close to zero such that (A16) is positive, while if $A_i \geq E(U_1 - U_0)/(4U_1) - K - \varepsilon$ (A16) is non-positive for all v. //

Proof of Proposition 1: By Lemmata 4(i) and 5(i) if $0 \leq A_i < K$, the incumbent's profits at the post-entry equilibrium are given by

$$\pi_i = \frac{E(U_1 - U_0)}{9U_1} - A_i \tag{A18}$$

which is maximised when $A_i = 0$. By Lemma 7(i) if $A_i \geq K + E(U_1 - U_0)/(9U_1) - \varepsilon$ the incumbent's profits are given by $E(U_1 - U_0)/(4U_1) - A_i$ whose maximum value is

$$\pi_i = \frac{5E(U_1 - U_0)}{36U_1} - K + \varepsilon \leq \varepsilon . \tag{A19}$$

Finally, by Lemma 7(ii) if $A_i \geq K$ and $A_i < K + E(U_1 - U_0)/(9U_1) - \varepsilon$ the incumbet's profits are given by (A18) whose maximum value (achieved when $A_i = K$) is negative. //

Proof of Proposition 2: By Lemma 4(i) if $A_i = 0$ the incumbent's post-entry profits are

$$\pi_i = \hat{R} . \tag{A20}$$

By Lemma 5(i) if $A_i \geq 5E(U_1 - U_0)/(36U_1) - K$ the incumbent's post-entry profits are given by $\pi_i = E(U_1 - U_0)/(9U_1) - A_i$, whose maximum value is

$$\pi_i = K - \frac{E(U_1 - U_0)}{36U_1} . \tag{A21}$$

By (23) for each $K < 5E(U_1 - U_0)/(36U_1)$ there exists a ε sufficiently close to zero such that (A21) is greater than (A20). Hence if advertising is sufficiently effective $A_i = 0$ is a dominated strategy. By Lemma 5(ii) if $0 < A_i < 5E(U_1 - U_0)/(36U_1) - K$ the incumbent's post-entry profits are given by $\pi_i = \hat{R} - A_i$: Since this is smaller than (A20), this is also a dominated strategy. By Lemma 7(ii) if $K \leqslant A_i < K + E(U_1 - U_0)/(9U_1) - \varepsilon$ the incumbent's post-entry profits are given by

$$\pi_i = E(U_1 - U_0)/(9U_1) - A_i$$

whose maximum value (achieved when $A_i = K$) is strictly less than (A21) for every $K > 5E(U_1 - U_0)/(72U_1)$. Hence this is also a dominated strategy. Finally, by Lemma 7(i) if $A_i \geqslant K + E(U_1 - U_0)/(9U_1) - \varepsilon$ entry is deterred and the incumbent's profits are given by $\pi_i = E(U_1 - U_0)/(4U_1) - A_i$, whose maximum value is

$$\pi_i = \frac{5E(U_1 - U_0)}{36U_1} - K + \varepsilon . \tag{A22}$$

Now, (A21) is greater than (A22) if and only if

$$K > \frac{E(U_1 - U_0)}{12U_1} + \varepsilon/2 . \quad // \tag{A23}$$

Proof of Proposition 3: To prove the first part of Proposition 3 it is sufficient to note that when K belongs to the range of values given by (31), (A22) is greater than (A21).

To prove the second part we note that by Lemmata 4(ii), 5(ii) and 7(iii), if $0 \leqslant A_i < 5E(U_1 - U_0)/(36U_1) - K$ or if $K \leqslant A_i < E(U_1 - U_0)/(4U_1) - K - \varepsilon$ the incumbent's profits are given by $\pi_i = \hat{R} - A_i$, whose maximum value (achieved when $A_i = 0$) is

$$\pi_i = \hat{R} . \tag{A24}$$

By Lemma 5(i) if $A_i \geqslant 5E(U_1 - U_0)/(36U_1) - K$ the incumbent's profits are given by $\pi_i = E(U_1 - U_0)/(9U_1) - A_i$ whose maximum value is

$$\pi_i = K - \frac{E(U_1 - U_0)}{36U_1} . \tag{A25}$$

Finally, by Lemma 7(iv) if $A_i \geq E(U_1 - U_0)/(4U_1) - K - \varepsilon$ the incumbent's profits are

$$\pi_i = E(U_1 - U_0)/(4U_1) - A_i ,$$

whose maximum value (achieved when $A_i = E(U_1 - U_0)/(4U_1) - K - \varepsilon$) is given by

$$\pi_i = K + \varepsilon . \tag{A26}$$

Now, (A26) is greater than (A25) and by (23) for every $K > 0$ there exists a v sufficiently close to zero such that (A26) is greater than (A24). //

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